possibility is suggested that fasciation of the ears may be a purely physiological effect of disturbed nutrition.

EMERSON[21] reports the discovery of red aleurone color as a latent character in a cross between Queen's Golden pop corn and Black Mexican sweet corn, though other crosses between these two varieties gave only purple aleurone. Crosses between a tested homozygous red-aleurone strain and White Rice pop corn and Evergreen sweet corn produced F_1's with only purple aleurone cells, thus demonstrating the presence of *P* as a latent character in both of these white varieties. Dark and light yellow endosperm colors were also seen to be latent as a result of a cross between the orange-colored Queen's Golden and the Black Mexican with colorless endosperm.

While not experimental, two papers by ILTIS[22] on abnormalities are worthy of mention. Both of these abnormalities are assumed to have been induced by the traumatic action of *Ustilago Maydis*. In the first the glumes of the female flowers were somewhat enlarged, and in place of the carpel arose a tubular structure 10–20 cm. long, terminated by a long pistil-like thread 20 cm. long. The occurrence of a ligule on this structure served to identify it as a phyllode, and leads the author to the conclusion that the ovary, which afterward forms the seed coat, is homologous with the leaf sheath, and the style with the leaf blade. Within this tube, as a prolongation of the axis, grew an abnormal leafy branch. In the second paper[23] the author describes abnormal inflorescences in which the flowers are paired, each pair consisting of a sessile female or hermaphrodite flower and a stalked male flower. This is an arrangement characteristic of the Andropogoneae, and the author looks upon its appearance in maize as a reversion. On this basis he would rank the Zeae as a subtribe of the Andropogoneae, in support of HACKEL and STAPF, who had adopted this arrangement on other grounds.—GEO. H. SHULL.

Lichen parasites.— TOBLER[24] has studied the relation of two so-called lichen parasites to the lichen host, to the alga on which the lichen grows, and to the substratum to which the lichen is attached. After the manner of thinking commonly followed by European botanists, and often by American as well,

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[21] EMERSON, R. A., Latent colors in corn. Ann. Rept. Amer. Breeders' Ass. **6**: 233–237. 1910.

[22] ILTIS, H., Ueber eine durch Maisbrand verursachte intracarpellare Prolifikation bei *Zea Mays* L. Sitzungsber. Akad. Wiss. Wien. Math.-naturw. Klasse **119**[1]. pp. 15. *pls. 2.* 1910.

[23] ILTIS, H., Ueber einige bei *Zea Mays* L. beobachtete Atavismen, ihre Verursachung durch den Maisbrand, *Ustilago Maydis* (DC.) Corda über die Stellung der Gattung *Zea* im System. Zeitschr. Abst. Vererb. **5**:38–57. *pls. 2.* 1911.

[24] TOBLER, F., Zur Biologie von Flechten und Flechtenpilzen. I. Ueber die Beziehungen einiger Flechtenparasiten zum Substrat. Jahrb. Wiss. Bot. **49**:389–409. *pl. 3. fig. 1.* 1911.

he considers the lichen to consist of the fungus and the alga on which it grows, instead of accepting the logical view, namely, that the fungus alone constitutes the lichen.

Phacopsis vulpina Tul. and *Karschia destructans* Tobler, of the Pezizineae, are considered with respect to their biological relation to the lichens on which they grow and to the algal hosts of these lichens. *Phacopsis vulpina* is found on the thallus of *Evernia vulpina* (L.) Ach. in the Alps. By sectioning the fungus and the lichen host together in paraffin and subsequent treatment with iodine solution, the author was able to trace the course of the *Phacopsis* hyphae in the lichen thallus, and to prove that they reach the inclosed algal host cells, which they closely and often completely entwine. In places where the *Phacopsis* is best developed in the lichen thallus, the algae are entirely absent. In other portions of the lichen thallus the algae are surrounded singly or in groups by the *Phacopsis* hyphae, the *Evernia* hyphae being absent from such places. In other places the hyphae of both *Phacopsis* and *Evernia* are found entwining the algae. Thus it appears that the *Phacopsis* hyphae in time reach the algae in limited areas of the lichen thallus and gradually displace the hyphae of the latter. It seems that the algae multiply more rapidly for a time after the *Phacopsis* hyphae reach them, but may finally disappear entirely where these hyphae are most abundantly developed. When the *Phacopsis* hyphae have reached the region of the lichen thallus where the algae are found, they spread laterally until large portions of the *Evernia* cortex are cut off from the medulla within and finally die. The *Phacopsis* hyphae are found to penetrate into the dead cortex and into the medulla of the *Evernia*. The foreign hyphae are absent from the spermagonia of the *Evernia* and areas immediately surrounding them, but are present in the soredia, which may serve as portals of entry. The conclusion is reached that the *Phacopsis* is probably first a parasymbiont and later a parasite on the lichen thallus.

Karschia destructans Tobler is described from the thallus of the lichen *Chaenotheca chrysosephala* (Turn.) Th. Fr. It was found that the *Karschia* penetrates into and through the crustose thallus of the *Chaenotheca* and into the bark upon which the lichen thalli examined grew. In growing through the lichen thallus, the *Karschia* is found to entwine and destroy algal cells and to displace and destroy the lichen hyphae. This makes the *Karschia* a parasymbiont with the lichen and likewise a parasite on it. But finally, the *Karschia* hyphae penetrate into the bark, after which the fungus fructifies. So before the fungus produces its fruit, it becomes a saprophyte. Thus a parasitic, a parasymbiotic, and a saprophytic condition are found in one ontogeny. The author reaches the conclusion that the *Karschia* is for a time a lichen-fungus (we would say a lichen), but at other times a parasite or a saprophyte. Whether this fungus is a lichen is really a matter of definition; but whether a given plant should be called a lichen or not is of no special biological importance. If its relationship with the alga is accompanied by no morphological characters which should separate it from the genus *Karschia*,

the fungus must remain in that genus. Several other species of *Karschia* are numbered among about 400 fungi that grow on lichen thalli, and a study of each of these would be of special interest and value.

The author states that his study of these two fungi proves that there can be no sharp separation of the many fungi known to grow on lichens into parasites, parasymbionts, and saprophytes, since a single species may show all three conditions at various times in its life history. He thinks that further studies would demonstrate that most of the fungi found growing on lichens are not purely parasitic, but parasymbiotic and often saprophytic as well. In this he is probably correct, and further research along this line would add much to our knowledge of the biological relations of these fungi. The conclusion is also reached that these studies tend to obliterate the line of demarkation between lichens and other fungi. This is true, but a considerable number of botanists have already concluded that the biological distinction between lichens and other fungi should not serve longer to maintain the lichens as a distinct group in any general classification of plants.

Some other fungi growing on lichens were examined briefly, without adding materially to the important results secured in the study of the two species considered above.—BRUCE FINK.

Evolution of vascular structures.—In a bulky memoir of 325 pages, CHAUVEAUD[25] expounds his view of the evolution of vascular bundles as they are found in different groups of plants. He finds himself in disagreement with the current notion of the stele as a morphological concept of first importance, and returns to the earlier view of a vascular bundle as the unit. With him, in fact, a vascular bundle is either a xylem or a phloem group, and these are arranged according to one of six "*dispositions*": (1) centric, corresponding to protostele; (2) excentric, with the xylem group more or less flattened; (3) alternate, represented by a root with diarch structure; (4) intermediate, as seen in the hypocotyl of some plants; (5) superposed, a circular row of collateral bundles; and (6) peripheral, represented by amphivasal bundles such as are seen in monocotyledonous stems. Thus what most writers call a protostele is by CHAUVEAUD, as well as earlier writers, regarded as the most primitive condition; the alternate arrangement of xylem and phloem exhibited by all roots is the next main step in evolution; and from this root structure are to be derived the conditions seen in the stems of gymnosperms and angiosperms. It will be seen that this mode of derivation lays a heavy responsibility on the hypocotyl, for this transitional region is considered to reveal the stages in evolution leading to the stem structure of all the higher plants. One must swear entire allegiance to the recapitulation theory when adopting this scheme, although certain difficulties appear, for instance, in connection

[25] CHAUVEAUD, G., L'appareil conducteur des plantes vasculaires et les phases principales de son évolution. Ann. Sci. Nat. Bot. IX. **13**:113–438. *figs. 218.* 1911.